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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/071,507	02/07/2002	Michael R. Krames	M-9152-1D US	4097

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EXAMINER

SOWARD, IDA M

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 03/31/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/071,507

Applicant(s)

KRAMES ET AL.

Examiner

Ida M Soward

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 10 is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11-20 is/are rejected.
- 7) ☒ Claim(s) 16 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 February 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 & 4-5. 6) ☐ Other:

DETAILED ACTION

This Office Action is in response to the application filed February 7, 2002.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "11" has been used to designate both **undoped layers** and **III-nitride layers** on page 10, paragraph [0040], and reference character "41" has been used to designate both **submount via conductive interfaces** and **wettable metals** on page 10, paragraph [0041]. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The abstract of the disclosure does not commence on a separate sheet in accordance with 37 CFR 1.52(b)(4). A new abstract of the disclosure is required and must be presented on a separate sheet, apart from any other text.

The disclosure is objected to because of the following informalities: the names between the title of the invention and "CROSS REFERENCE TO RELATED APPLICATION" should have been deleted.

Appropriate correction is required.

Claim Objections

Claim 16 is objected to because of the following informalities: "**corss**" should have been **cross** on line 1. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5.

Admitted Prior Art Figures 1-2 and 5 teach a light-emitting device comprising: a heterostructure of III-nitride materials comprising an active region; an n-electrode being attached to an n-layer; a p-electrode being attached to a p-layer; a supersubstrate having a refractive index of ~ 1.8; the p-electrode having an absorption of ~ 25%; a SiC supersubstrate; a supersubstrate attached to the heterostructure. In regard to the refractive index and absorption, 1.84 and 25.3% are approximately 1.8 and 25%, respectively, which is in the ranges stated in claims 1 and 3. However, Admitted Prior Art Figures 1, 3 and 5 fail to expressly teach an active region a peak emission wavelength. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made for the active region as taught by Admitted Prior Art Figures 1-2 and 5 to have a peak emission wavelength because by definition the

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peak emission wavelength is just the spectral line of a light emitter having the greatest power or the wavelength that suffers the lowest loss and the active region has a wavelength.

Claims 9, 12-16 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 as applied to claims 1, 3 and 5 above, and further in view of Inoue et al. (US 6,333,522 B1).

Admitted Prior Art Figures 1-2 and 5 teach all mentioned in the rejection above.

However, Admitted Prior Art Figures 1-2 and 5 fail to teach a portion of the p-electrode interposing portions of the n-electrode; a light emitting device comprising a submount; an n-interconnect connecting the n-electrode to the Si submount; a p-interconnect connecting the p-electrode to the submount; the n- & p-interconnects are selected from the group consisting of elemental metal and metal alloys; a p-conductive interface disposed between the p-interconnect and the p-electrode; and an n-conductive interface disposed between the n-interconnect and the n-electrode, wherein the n- & p-conductive interface comprise wettable metals and the lateral cross sectional area of the interfaces is at least 15% of the p-electrode. Inoue et al. teach a portion of the p-electrode interposing portions of the n-electrode (Figure 8B); a light emitting device comprising a submount 2; an n-interconnect 24 connecting the n-electrode 6 to the Si submount col. 25, lines 61-67); a p-interconnect 25 connecting the p-electrode 5 to the submount (Figures 6B and 20, cols. 16 & 26, lines 41-65 & 5-16, respectively); the n- & p-interconnects are selected from the group consisting of elemental metal and metal

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alloys (col. 16, lines 60-63); a p-conductive interface 73 disposed between the p-interconnect and the p-electrode; and an n-conductive interface 6-bottom disposed between the n-interconnect and the n-electrode, wherein the n- & p-conductive interface comprise wettable metals and the lateral cross sectional area of the interfaces is at least 15% of the p-electrode (Figures 2 & 8B, cols. 12 & 17, lines 31-34 & 53-58, respectively). Since, Admitted Prior Art Figures 1-2 and 5 and Inoue et al. are both from the same field of endeavor (light emitting devices), the purpose disclosed by Inoue et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 by incorporating the interposing electrodes as taught by Inoue et al. to enable a reduction in the area required by the electrodes to achieve electrical connection of the light emitting element (col. 2, lines 17-24).

Claims 2 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 as applied to claims 1, 3 and 5 above, and further in view of Krames et al. (US 2001/0000410 A1).

Admitted Prior Art Figures 1-2 and 5 teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 fail to teach a supersubstrate having an absorption coefficient 3 cm^{-1} at the peak emission wavelength and light being extracted from the active region through the substrate. Krames et al. teach a supersubstrate 12 having an absorption coefficient of less than 20 cm^{-1} (3 cm^{-1} lies within this range) at the

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peak emission wavelength (Figure 2, page 2, paragraphs [0023]-[0024] and light being extracted from the active region through the substrate (Figure 2, page 3, paragraph [0030])). Since, Admitted Prior Art Figures 1-2 and 5 and Krames et al. are both from the same field of endeavor (light emitting devices), the purpose disclosed by Krames et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 by incorporating the absorption coefficient as taught by Krames et al. to improve light extraction efficiency (abstract).

Claims 4 and 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 as applied to claims 1, 3, 5 and 11 above, and further in view of Krames et al. (5,779,924).

Admitted Prior Art Figures 1-2 and 5 teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 fail to teach at least one of the layers comprising the heterostructure is textured; at least one surface of the substrate is roughened; and a top surface area of the substrate is larger than a bottom surface area of the substrate. Krames et al. teach at least one of the layers comprising the heterostructure is textured; at least one surface of the substrate **3** is roughened; and a top surface area of the substrate is larger than a bottom surface area of the substrate (Figure 10, col. 8, lines 12-36). Since, Admitted Prior Art Figures 1-2 and 5 and Krames et al. are both from the same field of endeavor (light emitting devices), the purpose

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disclosed by Krames et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 by incorporating the surface texture, roughness & area of Krames et al. to improve light extraction by increasing the transmission of total optical power from the device (abstract).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 as applied to claims 1, 3, 5 and 11 above, and further in view of Furukawa et al. (5,124,779).

Admitted Prior Art Figures 1-2 and 5 teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 and 5 fail to teach a SiC substrate having a resistivity greater than 0.5 Ωcm . Furukawa et al. teach a SiC substrate 12a having a resistivity in the range of 0.1 to 1.0 Ωcm , wherein greater than 0.5 Ωcm is within this range (Figure 2, col. 4, lines 49-54). Since, Admitted Prior Art Figures 1-2 and 5 and Furukawa et al. are both from the same field of endeavor (SiC semiconductor devices), the purpose disclosed by Furukawa et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 and 5. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 and 5 by incorporating the resistivity as taught by Furukawa et al. to provide a silicon carbide semiconductor device with increased device reliability (col. 2, lines 42-66).

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Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 12-16 and 19 above, and further in view of Shigihara et al. (5,247,203).

Admitted Prior Art Figures 1-2 & 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 & 5 and Inoue et al. fail to teach a submount thickness of less than 250 μm . Shigihara et al. teach a submount thickness of approximately 150 μm , which is less than 250 μm (Figure 14, col. 1, lines 28-52). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Shigihara et al. are from the same field of endeavor (semiconductor devices), the purpose disclosed by Shigihara et al. would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 & 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 & 5 and the interposing electrodes as taught by Inoue et al. by incorporating the submount thickness of Shigihara et al. to avoid the degradation of light emitting characteristics (col. 1, lines 39-44).

Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art Figures 1-2 and 5 and Inoue et al. (US 6,333,522 B1) as applied to claims 1, 3, 5, 12-16 and 19 above, and further in view of Iranmanesh (5,521,440).

Admitted Prior Art Figures 1-2 & 5 and Inoue et al. teach all mentioned in the rejection above. However, Admitted Prior Art Figures 1-2 & 5 and Inoue et al. fail to teach a barrier layer disposed between an electrode and a conductive interface.

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Iranmanesh teaches a barrier layer 12 containing Ti disposed between an electrode 15 and a conductive interface 11 (Figure 1E, col. 3, lines 21-60). Since, Admitted Prior Art Figures 1-2 and 5, Inoue et al. and Iranmanesh are from the same field of endeavor (semiconductor devices), the purpose disclosed by Iranmanesh would have been recognized in the pertinent art of Admitted Prior Art Figures 1-2 & 5 and Inoue et al. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made modify the light emitting device of Admitted Prior Art Figures 1-2 & 5 and the interposing electrodes as taught by Inoue et al. by incorporating the barrier layer as taught by Iranmanesh to block the undesired inter-diffusion of material (col. 1, lines 27-30).

Allowable Subject Matter

Claim 10 is allowed.

The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not disclose, make obvious, or otherwise suggest the limitation of the p-electrode comprising Au/NiO_x/Al.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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The following patents are cited to further show the state of the art with respects to light emitting devices:

Edmond et al. (US 2003/0025121 A1)

Hide et al. (5,966,393)

Udagawa (6,153,894)


Ueta et al. (6,252,255 B1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ida M Soward whose telephone number is 703-305-3308. The examiner can normally be reached on Monday - Thursday, 6:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

ims
March 20, 2003


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
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